REMARKS/ARGUMENTS

We note with thanks that the Examiner has withdrawn objection to the drawings and claims 1-15 remain in the application.

Prior to addressing individual claim rejections, the Applicant makes the following preliminary comments:

With respect, it is noted that the Examiner's key grounds for rejections (a) do not account for the entirety of the subject matter claimed, and (b) overlook the full teaching of the prior art, as will be detailed below. It is trite that proper rejections must account for all elements of the claims. and must also be based on the full teachings of the prior art. In particular, the Applicant wishes to address three such areas:

- The Examiner's assertion that there is motivation to modify the prior art in the manner contended - the Applicant believes this is based on the false premise that the skilled reader would believe a hydropad seal is universally better than all other types of seals, regardless of seal environment;

- The Examiner's contention that the prior art must be the same as the claimed invention because the structure is not different - the Applicant believes the Examiner's has failed to appreciate the effect of the environment in which the seal is placed, and that environment (i.e. placement with the engine) is an aspect of what is claimed to be novel; and

- The Examiner's contention that all claim elements are taught by the prior art - the Applicant believes. in particular. that such is not shown at least in respect of claims 2. 7, 13 and 15.

Motivation

"As is known by those skilled in the art, the different bearing chambers along the shafts of a turbine are operationally equivalent, and therefore one skilled in the art would be motivated to apply the seal teaching of Tran et al. to every bearing chamber along the turbine shafts".

-Examiner Edgar, Page 3 of the Office Action

Hydropad seals are known in the art for use in situations where oil leakage to an adjacent air eavity is operationally unacceptable, so to speak. One example provided by Tran et al. (at column 2, lines 48-55) is air eavities from which bleed air is drawn - elearly it would not be aceeptable to have an oil smell in an aireraft eabin. It is to this problem which the hydropad seal is addressed. The unique nature of the seal strueture helps better ensure that oil does not eross the seal boundary into the air eavity. This advantage, however, does not eome without assoeiated eosts, namely:

- that hydropad seals are more expensive (due to their complexity) than other types of seals;
- that hydropad seals are heavier (due to their construction) than other types of seals; and
- that hydropad seals are less reliable (due to more moving parts) than other types of seals

These disadvantages are well-understood in the art. Consequently, Tran et al. and Flaherty et al. recommend use of their respective devices only where the taught benefits are available:

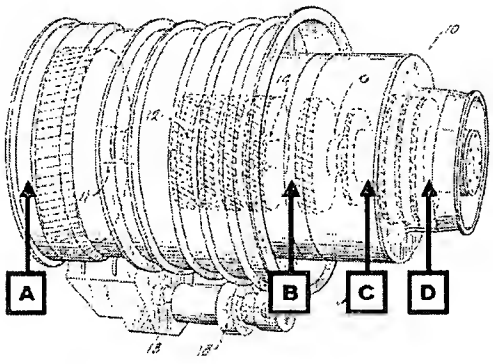
(a) Tran et al. diselose their new configuration to address the problem of oil migration "to eertain compartments of the turbomaehine" (column 1, lines 11-

14) where oil migration must be avoided. "since entry of oil into certain compartments would impair satisfactory operation...[for example compartments containing] various air bleeds call[ing] for the use of air which is clean and, in particular, oil-free" (Column 2, lines 48-55).

(b) Flaherty et al. discloses a seal which is also clearly not universally applicable within the engine, but rather for specific uses (at column 1, lines 49-67):

The present invention recognizes that grooved face seals are useful in applications other than in a fluid pump. For example, it has been discovered that grooved face seals provide significant benefits in terms of reduced heat generation and longer seal life when used in aerospace applications, such as on gear boxes, starters, constant speed drives and integrated drive generators. In fact, in some situations, significant benefits can be achieved by using grooved face seals to replace existing non-grooved seals. Surprisingly, this also has been found to work in situations where the seal is exposed to atmospheric pressures substantially less than 14.7 psia, such as when the seal is being used in an aerospace application (e.g., an aircraft) at altitude. In addition, the present invention has discovered a cost effective method for forming the grooves on the seal rings, thereby making the grooved seals applicable to a larger number of applications where cost may be an issue. Furthermore, a unique and simple hydropad configuration has been developed. [emphasis added].

This non-universality, so tot speak is further made clearer by Flaherty et al. in their Figure 1, reproduced below. Notably absent from discussion are several bearing assemblies, indicated by "A" through "D" below. By comparison, the present application teaches the use of hydropads at these locations (14 and 16 in Figure1 of the present application, below, correspond to "A" and "D" indicated in Flaherty):



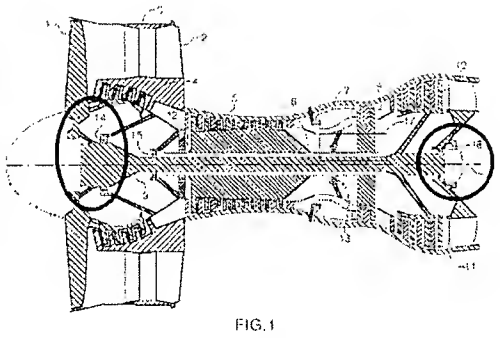


Figure 1 of Flaherty et al.

Figure 1 of the Present Application

Why does Flaherty et a. not explicitly teach using their invention at locations A-D? Simply because hydropad seals are more expensive, heavier and complex than regular seals, and therefore should only be used where needed to prevent oil flow to critical air cavities. (Note that the locations 11-16 indicated by Flaherty et al. are adjacent such critical air cavities). In other words, since at least locations A and D (or 14 and 16 in the present application) are locations at which some oil leakage is permissible, Flaherty et al. naturally do not teach using their device at these locations. Since oil leakage at locations A-D is inconsequential, relative to the other critical locations indicated in Flaherty et al. - the use of regular seals is implicitly understood to reduce cost, weight and complexity - and therefore the reasons for their omission from Figure 1 of Flaherty is clear to the skilled reader. This aspect of hydropad seals would not be new to the skilled reader, and would be implicitly understood in reading Tran et al., as well.

In summary, the Examiner's assertion that all bearing cavities are "operationally equivalent" is not correct. The bearing cavities are in fact quite different based, for example, on whether nominal oil-leakage from the compartment may be tolerated or not. Furthermore, as will be addressed below, both Flaherty et al. and Tran et al. teach the presence of a positive airflow through the seal - obviously, then, any bearing cavities in which a positive airflow is not present cannot be "operationally equivalent" of the bearing cavities taught in these references.

Because of increased weight, cost, etc., hydropad seals cannot be said to be somehow "universally better" than other types of seals, and thus the skilled reader would not be motivated to replace all seals in the engine without further excuse. Flaherty et al. acknowledge that "cost may be an issue" (see at column 1, lines 49-67, quoted above). Tran et al. implicitly acknowledges the same, by directing focus to "certain compartments".

Therefore, in order to maintain a finding of *prima facie* obviousness, the Examiner

must provide a basis upon which the skilled reader would ignore both (a) the detriment of undue cost, weight and decreased reliability, of hydropad seals added without apparent reason,,and (b) the direct teaching of Tran et al. and Flaherty et al. that hydropad seals are to be used at so-called "critical" locations. The Examiner has not done so, and the rejections based on such grounds are therefore improper.

Comparison of Applicant's Seal Structure to Prior Art Seal Structure

"[Although] both references [i.e. Tran et al. and Flaherty et al.] teach a small volume of air being introduced into the bearing chamber, Applicant's invention must also introduce air into the bearing chamber since all of the elements are identically arranged. Applicant has not provided any additional teaching or element that would prevent air from entering the bearing chamber under operational conditions of the seal"

-Examiner Edgar, Page 4 of the Office Action

"The hydropad seals do not merely reduce airflow but rather unlike conventional seals do not rely on air flow through the bearing cavity seals to prevent oil leakage. Hydropad seals are independent of air flow and may accommodate a positive, negative or zero pressure differential between the interior of the bearing cavity and the ambient

engine area....Since the air can enter the bearing cavity through some of the hydropad seals and then exit through other hydropad seals, the breather or oil/air separator can be eliminated entirely."

-Present application, page 5, paragraphs [0010 and [0011]

With respect, it is not necessarily the seal of the present invention which is different than taught in the prior art, but rather the placement of the seal within the engine - i.e. the environment of the seal is the key factor to consider, and not necessarily its structure. The admission of air into the prior art seals is not ultimately due to the seal structure, but rather to the seal's placement in the engine, i.e. in an environment in which a positive air pressure exists.

The present invention, however, does not restrict the placement of the seal using prior art constraints - but rather the inventor has discovered that an as-of-yet unrecognized benefit (reduced oil consumption) can be achieved by placing the seal throughout the engine, irrespective of surrounding environment, so as to achieve the benefit. The mere teaching by the prior art of the positive air flow is indicative of the prior art's lack of appreciation that a benefit is available in any bearing cavity, regardless of air pressure gradient.

And, contrary the allegation that the present application *"has not provided any additional teaching or element that would prevent air from entering the bearing chamber"*, the present application teaches that "prevention" is not required, as air admitted in an region of positive air pressure differential will be permitted to escape elsewhere in the system through a seal subjected to neutral, or negative air pressure differential.

Therefore, Tran et al. and Flaherty et al. "require" a positive pressure differential not so much as by their respective structures, but because they are constrained by the

prior art notion that such seals are placed in the engine only in an environment where an air pressure differential is available. The conclusion is inescapable.

Therefore, to compare the structure of the seals of the present invention to that of Tran et al. and Flaherty et al. is to misdirect oneself away from the invention. This "requirement" of the prior art is indicative of their narrow view of the use of the seal, and therefore affirmative of the patentability of the present concept.

The Examiner's assertion of *prima facie* obviousness is therefore deficient, as it does not address why the skilled reader would be motivated to discard the teachings of Tran et al. and Flaherty et al. and include such a seal in a neutral- or negative-pressure environment. The rejections are therefore also not sustainable for this reason.

Oil Separator/Air Breather

Tran et al. explicitly disclose the presence of an oil separator in the intended oil system (see column 3, line 38-42). In other words, Tran et al. unequivocally teaches the use of a conventional air/oil system.

US 4,531,358 to Smith discloses a oil system having a breather 30 for venting the system of entrained air (see Figure 1). The importance of, and the construction of, this separator/breather is discussed at length (column 3 lines 12-26). Smith thus unequivocally teaches the use of a conventional air/oil system.

Flaherty et al. is silent on any assoeiated air/oil system and, therefore, cannot be said to provide any teaching contrary on this issue to the other prior art.

The Examiner has not, therefore, provided any grounds for rejecting claims relating to this subject matter, including at least claims 2, 7, 13 and 15. The continued

rejection of these claims, therefore, would be improper as the requirements of §103(a) have not been met.

Claim Rejections

Claims 1-15 are rejected under §103(a) based on Tran et al. in view of Smith '358.

As noted above, (a) a hydropad seal is presented by Tran et al. to address a specific concern not present in all bearing chambers of a gas turbine engine (i.e. all bearing chambers in a gas turbine are not "operationally equivalent", as alleged); (b) cost, weight and reliability factors gravitate against capricious inclusion of this type of seal where specific benefit is not identified (i.e. a hydropad seal is not "universally better" than all other seals); and (c) requiring a positive airflow across the seal teaches away from inclusion in bearing cavities not surrounded by high pressure air, or more specifically bearing cavities remote from the high pressure regions of the gas path (i.e. Tran et al. clearly does not teach any benefit of use in other environments).

Smith does not address any of these deficiencies of Tran et al., nor has the Examiner proposed why one skilled in the art would be inclined to ignore such considerations.

As also noted, no basis whatsoever has been provided for the rejection of at least claims 2, 7, 13 and 15, as all elements of these claims have not been alleged to have been disclosed or taught by the prior art or constitute common knowledge in the art.

Claims 1-15, therefore, have not been demonstrated to be unpatentable, and it is respectfully requested that the rejections be therefore withdrawn.

It is submitted that all of the Examiner's objections have been overcome. Favourable consideration and allowance of this application are respectfully requested.

January 21, 2004

Respectfully submitted,

OGILVY RENAULT

By _____
Paul J. Field
Reg. No. 34,963
Direct Dial (416) 216-3903
Direct Fax: (416) 977-5239

E-mail: pfield@ogilvyrenault.com